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MDO FRAMEWORK REQUIREMENTS UPDATE FOR SECOND VIVACE ITERATION

Executive Summary

Aircraft and their engines are complex, mature, high-tech products. Economic and societal realities imply the need for further improvement of various product characteristics. As single discipline design methods are maturing and consequently becoming optimised, this provides an opportunity to consider several interacting disciplines in the optimisation i.e. perform Multidisciplinary Design Optimisation (MDO). Several of the aircraft and engine subsystems are mature, complex systems in their own right. This provides an opportunity to also apply MDO techniques at subsystem level.

The European Union Framework 6 programme sponsors the Value Improvement through a Virtual Aeronautical Collaborative Enterprise (VIVACE) [1] as an Integrated Project. Given the importance of MDO and the expected benefits of its deployment in aircraft and engine design, VIVACE has dedicated a work package to MDO. In the first VIVACE iteration potential users emerged, which are represented by four Use Cases:

- Wing Design Optimisation;
- Preliminary and Unconventional Design (Prelude);
- Complex subsystem;
- Whole Engine Model.

In order to provide early benefits to the users and guide the subsequent MDO work, an evolutionary approach [2] to MDO developments has been implemented. In the first VIVACE iteration requirements have been produced [3]. These requirements have been developed into services specifications [4], which have been implemented [5].

To obtain feedback from potential MDO framework users for the update of the MDO framework requirements, the following approach was used. Firstly, the VIVACE MDO Use Cases have analysed the results as documented in [5] and the additional material as supplied to them. Secondly, to obtain a quick response from the wider aerospace MDO community, the first iteration results have been presented and demonstrated at the VIVACE Forum 1. In the session 4 “Cost reduction through multidisciplinary design processes” an overview of MDO was presented and three of the four MDO use cases showed their MDO results The fourth MDO use case was shown jointly with the work package on the collaboration hub for heterogeneous enterprises in the session 6 “Demonstration of an IT environment to enable

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development cost reduction and design quality improvement in a multi-disciplined extended enterprise scenario". Two MDO Use Cases delivered additional information in scientific papers for the Forum [11, 12]. These presentations were well-attended, many questions were posed by the public, and fruitful discussions were held afterwards.

Additionally, results have been disseminated through scientific papers for several conferences, symposia, etc also outside the aerospace domain. These venues include RIVF'05, EUCASS 2005 and EUROGEN 2005. These general dissemination activities provided additional response from a larger community.

This combined feedback from potential MDO framework users has resulted in a thorough re-assessment of the MDO requirements from the first iteration. For the first use case, on wing MDO, after good progress on the first scenario, work will continue as worded in the two scenarios. For the second use case on preliminary and unconventional design MDO effort will be concentrated on the scenarios which promise the most near-term benefits while de-emphasizing the more complex and less mature scenarios. For the third use case on complex subsystems the single scenario has evolved into four more detailed scenarios of which the first has been completed. Work will start on the second one. For the last use case, on whole engine MDO, its first scenario has been achieved, resulting in commencement of the second scenario. For those scenarios which are planned for elaboration in VIVACE's second iteration, the updated requirements will now be specified further and implemented in the MDO framework. Through the assessment by the MDO framework user community, the MDO implementation results from the first VIVACE iteration will fit even more smoothly into the advanced capabilities integration activities that are currently being established.

In parallel with the MDO work package, the other work packages of the advanced capabilities sub-project have progressed as well during the first VIVACE iteration. The results obtained and increased understanding allow starting of the integration of the advanced capabilities into a concept denoted as VIVACE-in-a-box. The current ideas are depicted in Figure 1.1.

VIVACE D3.2.1 2 MDO Framework Requirements Update For Second VIVACE Iteration

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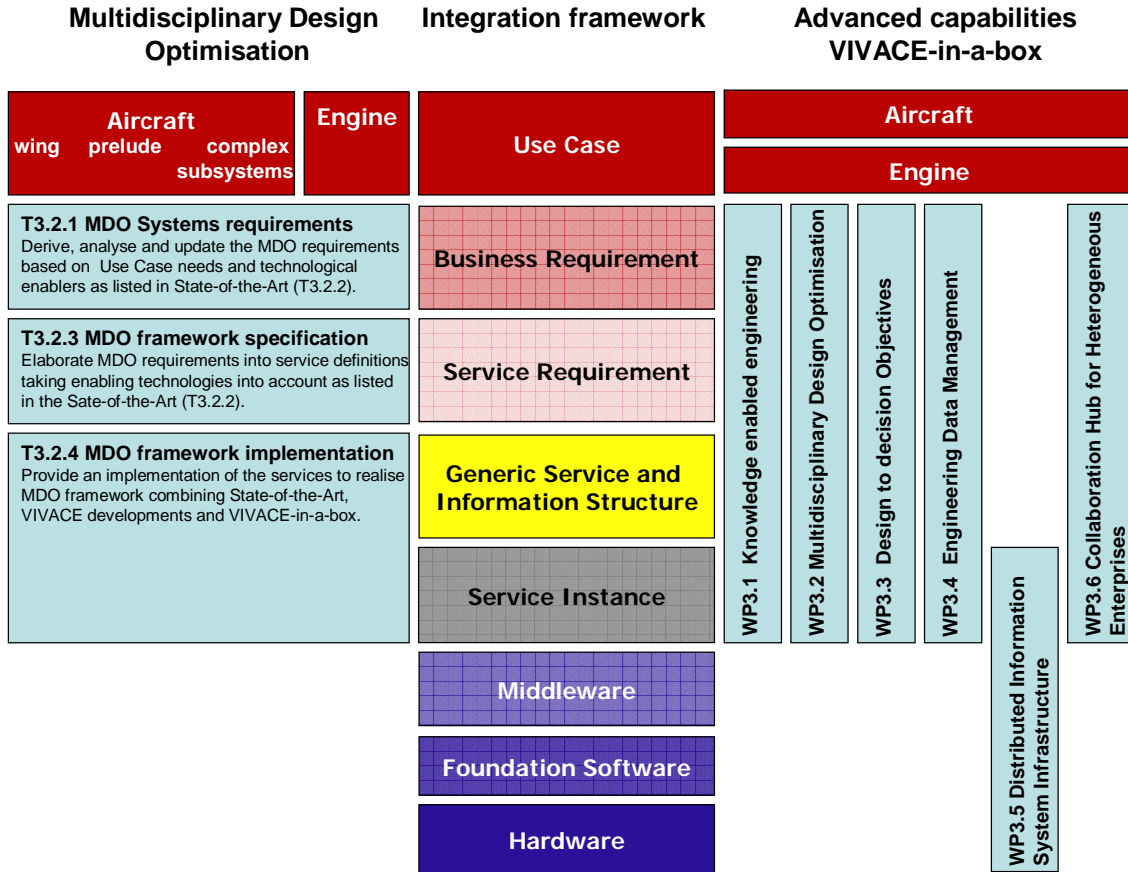


Figure 1.1: Overview VIVACE integration framework, MDO activities and advanced capabilities for VIVACE-in-a-box concept

The central part of the figure shows the general integration framework of the VIVACE-in-a-box. The left side of Figure 1.1 maps the Multidisciplinary Design Optimisation activities onto this model. The right side of Figure 1.1 shows the commonalities and complementary nature of the current advanced capabilities activities. The integration of the advanced capabilities, consisting of methods, tools and processes, is the VIVACE technical objective, i.e. a distributed concurrent engineering environment to support the aeronautical virtual enterprise, as worded in the Description of Work [1].

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